



NOsparc MMYac™

PATENT PENDING



“CONTACT PROTECTOR”

**Across the Contact Arc Suppressor
For AC Power Applications**

User Manual



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IMPORTANT NOTES

This document provides information required to install and use your new NOsparc MMYac contact saver. We therefore strongly recommend reading this manual both thoroughly and completely before installing this arc suppression device.

If you have any problems with your installation, please refer to Technical Support contact information on the last page of this manual.

TRADEMARKS:

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APPLICABLE DOCUMENTS:

Underwriters Laboratories
NKCR2 “Auxiliary Devices - Component”



File No.: 3446457

The above mark indicates that Underwriters Laboratories, inc., has certified the NOsparc MMYac as a UL Recognized Component for both Canada and the United States.

LIFE SUPPORT:

Arc Suppression Technologies products are specifically NOT authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Arc Suppression Technologies.

As used herein:

- Life support devices or systems are devices or systems which
 - are intended to implant into the body, or
 - support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.
- A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely

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LEGAL NOTICE:

Information in this document is believed to be accurate and is provided solely in connection with Arc Suppression Technologies products.

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Arc Suppression Technologies only accepts products for repair or return that are accompanied by a Return Material Authorization number from the appropriate distributor or sales representative.

Please refer to your original purchase agreement or contact your distributor or sales representative for return policy information.

SAFETY INFORMATION OVERVIEW

We use note, caution and warning symbols throughout this book to draw your attention to important operational and safety information.



CAUTION or
WARNING



Electrical
Shock
Hazard
CAUTION or
WARNING

"WARNING" describes an alert with information that is important for protecting personnel and equipment from damage.

"CAUTION" describes any condition that could result in damage to the equipment or result in physical harm to personnel.

The "SAFETY" alert symbol (an exclamation mark in a triangle) precedes a general CAUTION or WARNING statement. It describes safety requirements to meet local, national and international standards.

The electrical hazard symbol, (a lightning bolt in a triangle) precedes an electric shock hazard. It describes a potential electrical shock hazard which can result in personal injury or death.

"NOTE" describes any item of interest to the user, owner or operator.

WARNINGS:

Follow extreme caution when applying NOsparc MMYac to trip and close contacts or in circuits containing elements that can be energized by a 1/2 power cycle pulse. This User Manual must be thoroughly understood and accurately followed to avoid unintended equipment operation.



Components covered by UL's Recognized Component program are intended to be installed in another device, system or end product. They are to be installed at the factory, not in the field.

The PCB and assembly must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in personal injury or loss of life. See the product rating curve for wire gauge selection, ambient temperature and current restrictions.



Follow extreme caution when conducting short cycle time tests, especially below the maximum rated cycle time for the associated relay; typically 3s. Even at significantly reduced power levels through the contacts, the relay contacts can become extremely hot due to contact arcing and pose a fire danger. ALWAYS FOLLOW THE RELAY MANUFACTURERS SPECIFICATIONS AND REQUIREMENTS. Standard relays typically have a maximum short period cycle time of 1200 cycles per hour.



Always test the function and performance of NOsparc MMYac in the intended application.

An arc suppressor DOES NOT eliminate arcing, therefore, use of the NOsparc MMYac will not eliminate hazards associated with electrical current contact arcing.

**SAFETY:**

All creepage distances and clearances of NOsparc MMYac have been designed to meet requirements of safety standards.

When using NOsparc MMYac, basic safety precautions should always be followed to reduce risk of fire, electric shock, and injury to persons. When installing NOsparc MMYac into your system, make sure that the Quick Connect Terminal connector is properly crimped, terminated, insulated and that the proper wire gauge is used and that the connector is securely seated. Incorrect application or termination can result in harmful or fatal electrical shock or component damage.

**CAUTIONS:**

Just like a snubber, the NOsparc MMYac will pass a small leakage current (see specifications) even though the contacts across which it is connected are open. This capacitive leakage current can be sufficient to turn-on some solid state and electromechanical relays, or to cause electric shock to personnel. Therefore:



- The NOsparc MMYac (or a snubber) must never be connected across relay or contactor contacts driving high impedance loads.
- The NOsparc MMYac (or a snubber) must never be connected across relay or contactor contacts used for galvanic/safety isolation.

Proper care must be taken when handling and installing NOsparc MMYac.

Never plug or unplug NOsparc MMYac while powered.

Do not connect NOsparc MMYac directly to power!

Use caution when installing or modifying power connections.

Soldering wires directly to board mounted NOsparc MMYac™ terminals is not recommended. (For product evaluation, please use the NOsparc MMXac™ which is a panel-mount version of this arc suppressor having FASTON connectors.)

NOTES:

Connect NOsparc MMYac across the power switching relay or contactor contacts only!

NOsparc MMYac capabilities will be fully effective even under mixed load conditions.

NOsparc MMYac has been designed to support the following AC power loads:

- | | | |
|-------------------|-------------|--------------|
| • General Purpose | • Inductive | • Ballast |
| • Resistive | • Motor | • Pilot Duty |
| • Capacitive | • Tungsten | |

DO NOT use NOsparc MMYac for DC power applications.

DO NOT use NOsparc MMYac under the following power conditions:

- Non-sinusoidal power circuits
- Phase controlled power circuits

DO NOT connect NOsparc MMYac across the following components:

- | | |
|--------------------|---------------------|
| • Fuses | • Safety interlocks |
| • Circuit breakers | • Thermal limits |

DO NOT use NOsparc MMYac either above or below its ratings or specifications.

DO NOT operate the contacts to which the NOsparc MMYac is attached above or below their ratings or specifications.

PRODUCT DESCRIPTION

NOsparc MMYac is a two terminal contact arc suppressor that attaches across the contact points of a power relay or contactor. The product is designed to protect the contact points from premature destruction due to contact current arcing.

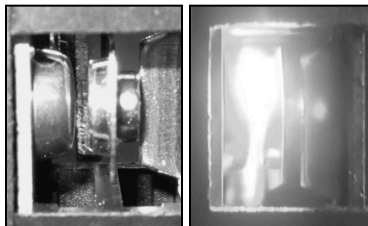
BACKGROUND:

Electromechanical power relays or contactors without load current may have potential mechanical lifetimes of 10M, 20M or even more operations (cycles). This mechanical lifespan, however, is reduced to as few as 5,000 operations to perhaps 100,000 operations (depending on application and specifications) when the relay or contactor is operated under power.

This is mainly caused by the deleterious effects of load current arcing across the relay's or contactor's contacts as they open (transition from closed to open, or "BREAK") and close (transition from open to closed, or "MAKE").

Relay / Contactor State Table		CONTACT STATE	
		Off	On
COIL STATE	Energized	MAKE → CLOSED	
	De-energized	↑ OPEN	↓ BREAK

The arcing across the contacts is literally a small lightening bolt.



Left: Contacts of a T9A-style relay.

Right: Electrical contact current arc across the contact points of a similar T9A-style relay.

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The destructive power of the arcing may be better described using the following analogy:

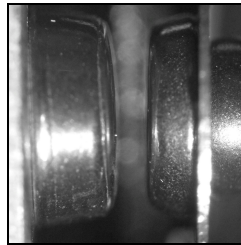
- Contact opening (BREAK) is akin to an arc welding process using the relay or contactor contacts as the arc welding electrodes.
- Contact closure (MAKE) is akin to a spot welding process using the relay or contactor contacts as the spot welding electrodes.

ARC SUPPRESSION AND CONTACT PROTECTION:

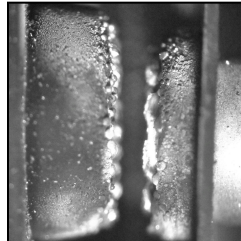
NOsparc MMYac detects the nascent arc as it forms and suppresses its energy all within about 5μs (5 millionths of a second!). The result is a low energy "arclet" with arc energy of only a few μJ as opposed to a full contact arc that is hundreds of mJ (or more). This allows an arc suppression factor to be calculated from the difference in energy. For example, at 20A, 240V, the NOsparc MMYac has an arc suppression factor of 1250. (More information on the Arc Suppression Factor is available on our website and from a down-loadable document: Lab Note 103 — "Snubbers; Are They Arc Suppressors?")

Please note that this residual "arclet" is important as it both burns through the protective thin film coating during initial operation, and subsequently cleans of the contact surfaces during normal relay operation.

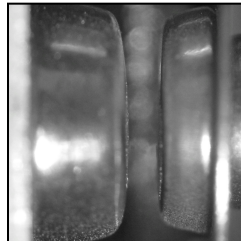
The effects of contact protection may be seen in the following pictures:



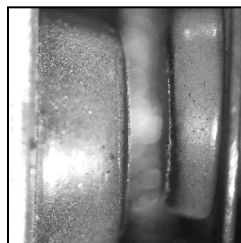
Contacts of a T9A-style relay, unused.



Contacts of a T9A-style relay after 100,000 cycles within specified operating limits, without arc suppression.



Contacts of a T9A-style relay after 100,000 cycles within specified operating limits, with arc suppression.



Contacts of a T9A-style relay after 1 million cycles within specified operating limits, with no arc suppression.

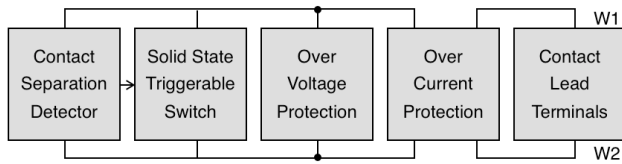
(More information on the Arc Suppression Factor is available on our website and from a down-loadable document: Lab Note 107 - AUG2011 - "Relay Life 1M")

CHARACTERISTICS:

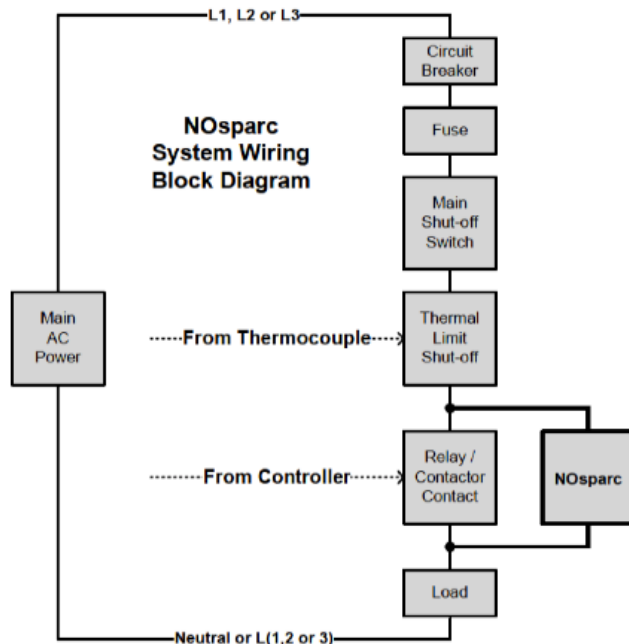
The NOsparc MMYac may be thought of as a "super snubber" if a snubber were capable of suppressing arcs in power applications (which they are not; see our website for the document: Lab Note 103 — "Snubbers; Are They Arc Suppressors?") Another imperfect analogy is that the NOsparc MMYac is akin to a very large capacitor connected to the contacts of a relay or contactor. Such a capacitor would make a great contact arc suppressor, however, due to the capacitors high discharge currents the very same capacitor that saves the contact from surface erosion (damage) due to break arcing during contact opening, would also spot weld with its discharge current through the contacts during contact closure and effectively weld/fuse the contacts permanently together.

Just like a capacitor, NOsparc MMYac will subject the load to a surge current. NOsparc MMYac is designed to withstand very high

surge currents (see “Contact Make Inrush Current Arc Suppression Capabilities” on page 9 of this manual).

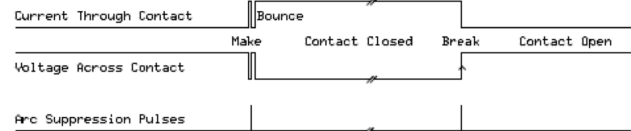


NOsparc MMYac extends contact life without requiring any external control wires, power wires or any other wires other than the two contact terminal wires that are used to connect the device to the associated power relay or contactor.



NOsparc MMYac requires only two wires to monitor the contact status in order to suppress the contact current arc in the instant when the contact transitions from close to open state. This occurs both during the contact BREAK and the “bounce arc” associated with the contact MAKE.

Arc Suppression Timing Diagram:



RELAY END-OF-LIFE (EOL):

Every relay has a finite operating lifetime. For example: If a power relay with a 100,000 cycle electrical life is operated once every minute (60s), it will reach its EOL in a mere 69 days! (This is why contactors are often used to prolong operating life ... it just takes longer to destroy their contacts.)

NOsparc MMYac extends the inevitable end-of-life of a standard relay/contacter by a factor of 100 times or more under normal, specified relay operating conditions (please refer to the relay's specifications). This allows the lifespan of a NOsparc MMYac suppressed relay operating under load to actually approach the relay's expected mechanical lifespan.

The natural end-of-life (EOL) is failure in one of the following three modes:

1. Contact fails closed
2. Contact fails open
3. Contact fails with resistance

All three modes are undesirable however their timing can be delayed if the contacts are operated well below their maximum rated specifications. This inevitable EOL can be extended out even further with the proper use of a NOsparc MMYac.

In fact, under normal operating conditions, the relay should fail well before the arc suppressor.

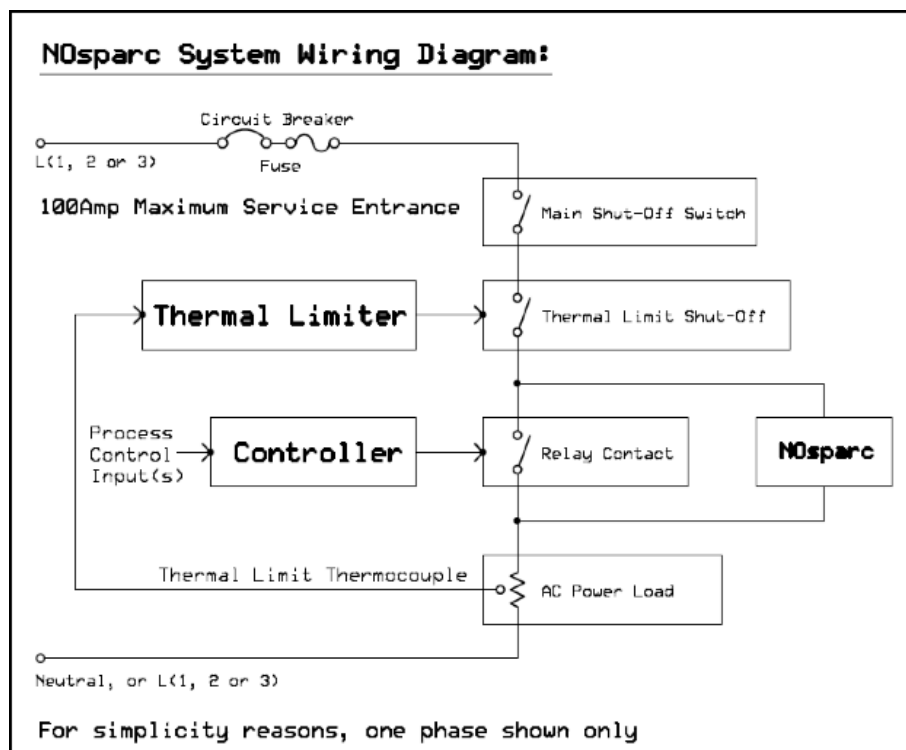
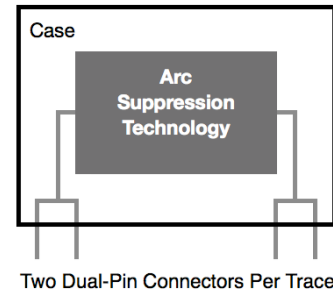
SYSTEM WIRING

NOsparc MMYac has two dual post pins for mounting on a printed circuit board for the relay or contactor requiring contact protection.

In order to provide effective arc suppression, the two traces between NOsparc MMYac and the relay or contactor contact terminals should be as short, wide and thick as possible, per the following:

- Trace Length should not to exceed 12"
- Trace width should be 0.1" minimum
- Trace thickness should be 1Oz copper or heavier

All four pins must be firmly soldered and connected to the individual traces (i.e., a dual-pin connector for each trace).



SPECIFICATIONS**ARC CURRENTS:**

Break "Steady-State" (contacts opening)
 Make "Inrush" (contacts closing)

ARC SUPPRESSION:

Duration 1/2 cycle (maximum)

CIRCUITS:

Single Phase One (1) (multiple units for multiphase operation)

CIRCUIT FUSE RATING:

Maximum 50A (DO NOT exceed this fuse rating)

CONTACT CYCLING:

Maximum Cycle Time 125ms (DO NOT exceed relay cycle time operating specifications)

DIMENSIONS:

Length 1.000" (2.540cm)
 Width 0.470" (1.195cm)
 Height 0.920" (2.335cm)

ENVIRONMENTAL:

Operating Temperature -40°C To 85°C (-40°F to 185°F)
 Storage Temperature -50°C To 125°C (-58°F to 257°F)
 Humidity 5% to 95% (non Condensing)

FREQUENCIES:

Typical Operating Frequency 60Hz (North American Power Frequency)

INTERFACE WIRES:

Across Relay or Contactor Two (2) (W1 / W2 non-polarized)

LEAKAGE:

Leakage Current 0.2/10mA (12/277Vac)

POWER-ON:

Load Current Passthrough 1/2 cycle (maximum)

PRINTED CIRCUIT BOARD (PCB) MOUNTING:

Orientation Any (see "BOARD AFFIXATION" section of this manual)
 Four plated through holes 0.038" diameter (on Printed Circuit Board (PCB))

RELIABILITY:

MTBF 50,000 Years (MIL-HDBK-217F)

TERMINATION:

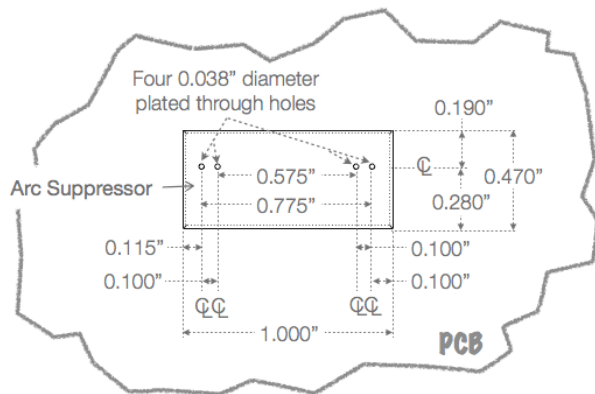
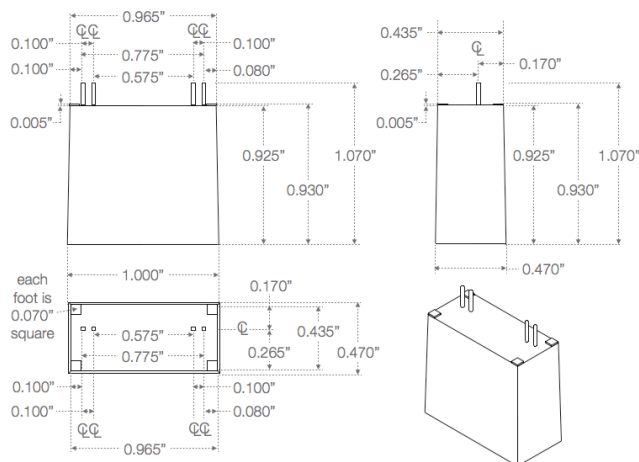
Two dual posts 0.025" square posts (0.1" center)

VOLTAGES:

Minimum Operating Voltage 12Vac (lowest open contact voltage)
 Maximum Operating Voltage 277Vac (highest open contact voltage)
 Maximum Varistor AC Voltage 300Vrms (refers to varistor within device)
 Typical Varistor Clamping Voltage 470V (at 1mA)

WEIGHT:

Net Weight 1/2 Oz (14g)

FOOTPRINT AND UNIT DRAWINGS**PCB FOOTPRINT:****CASE DIMENSIONS:****BOARD AFFIXATION****WAVE SOLDERING GUIDELINE:**

Arc Suppression Technologies recommends using a rosin-based, non-corrosive flux during the wave solder process. The NOsparc MMYac™ is completely epoxy sealed.

WATER WASH GUIDELINE:

Arc Suppression Technologies recommends using a de-ionized water cleaning process. The NOsparc MMYac™ is completely epoxy sealed.

HAND SOLDERING GUIDELINE:

Arc Suppression Technologies recommends using a rosin-based, non-corrosive flux solder wire using a 60W maximum soldering tool. Solder tool should not touch terminals for more than five (5) seconds. Optimal solder temperature is 350°C.

DEFINITIONS

Arc Current	Plasma current supported between open contacts
Arc Suppression Duration	Time during which the electrical current contact arc is arrested
Arc Suppressor	Device designed to reduce contact arcing
Break	Action of a contact which transitions from close to open
Bounce	One or more brief transition to the OPEN state as the contact is closing during the MAKE phase
Break Current	Contact current during Break
Cycle Time	Time between successive ON or OFF contact states
Inductive Load	Motor or transformer form the main part of the load
Inrush Current	Resulting turn-on current when powering an inductive, capacitive or tungsten load
Inrush Current Limiter	Device intended to limit the amount of turn-on current when powering an inductive, capacitive or tungsten load
Make	Action of a contact which transitions from open to close
Make Current	Contact current during Make
MOV	Metal Oxide Varistor
MTBF	Mean-Time-Between-Failures
Power-On Passthrough	Current passing through the arc suppressor during initial power-up
RC Snubber	Device with resistor and capacitor in series across contact
Suppression	Action of minimization of undesired event
Varistor Clamping Voltage	Voltage at which steady state current through the arc suppressor is $\geq 1\text{mA}$
Maximum Varistor AC Voltage	Maximum allowed voltage across the arc suppressor (NOT operating voltage)

WARRANTY

Please contact your distributor or sales representative for warranty information.

TECHNICAL SUPPORT

Please contact your distributor or sales representative with technical support and product support questions.

Have the following information available when contacting your representative:

- Model Number
- Serial Number

In certain circumstances, direct product support from Arc Suppression Technologies may be reached via the following communication methods:

- support@ArcSuppressionTechnologies.com
- <http://arcsuppressiontechnologies.com/Support.aspx>
- (612) 928-5546

CONDITIONS FOR SERVICE

In the event of a product malfunction, Arc Suppression Technologies or an authorized agent should perform all repairs to a NOsparc MMYac unit. It is the responsibility of users requiring service to report the need for service to their distributor or sales representative.

Any components, devices or other equipment used with or adjacent to a NOsparc MMYac device is the sole responsibility of the end user and not of Arc Suppression Technologies or any of its agents, resellers, representatives or distributors.

RETURN MATERIAL AUTHORIZATION AND PROCESS

Authorization prior to returning product is required. Please refer to your original purchase agreement or contact your distributor or sales representative for an RMA number and instructions before returning product.

NOTE: Terms and conditions vary by distributor and representative. Please refer questions to your distributor or sales representative.

CONTACT INFORMATION

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Your Comments:

We welcome your comments or suggestions on this User's Manual.